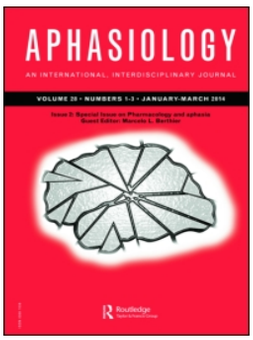
Assessing comprehension and production of verbs and sentences

Bastiaanse, Y.R.M.; Edwards, S.; Maas, E; Rispens, J.E.

Published in:
Aphasiology

DOI:
10.1080/729254890



Aphasiology

ISSN: 0268-7038 (Print) 1464-5041 (Online) Journal homepage: http://www.tandfonline.com/loi/paph20

Assessing comprehension and production of verbs and sentences: The Verb and Sentence Test (VAST)

Roelien Bastiaanse , Susan Edwards , Edwin Mass & Judith Rispens

To cite this article: Roelien Bastiaanse , Susan Edwards , Edwin Mass & Judith Rispens (2003) Assessing comprehension and production of verbs and sentences: The Verb and Sentence Test (VAST), Aphasiology, 17:1, 49-73, DOI: 10.1080/729254890

To link to this article: https://doi.org/10.1080/729254890

Published online: 10 Sep 2010.

APHASIOLOGY, 2003, *17* (1), 49–73

Assessing comprehension and production of verbs and sentences: The Verb and Sentence Test (VAST)

Roelien Bastiaanse
University of Groningen, The Netherlands
Susan Edwards
University of Reading, UK
Edwin Maas and Judith Rispens
University of Groningen, The Netherlands

Background: In this paper we present a new aphasia test for the asessment of comprehension and production of verbs and sentences, the Verb and Sentence Test (VAST). A description is given of selected theories underlying the construction of the test, the diagnostic properties, and how results from the test can be used to motivate therapy.
Methods & Procedures: Information about the construction and standardisation of the VAST is provided. Justification for item selection and results obtained from 80 non-aphasic and 25 aphasic subjects are described. Details are given of the discriminative power of each task, and validity and reliability are discussed.
Results: Data from the subjects demonstrate that the VAST effectively discriminates between the aphasic and non-aphasic population and between different types of verb and sentence deficits. Case studies are given to illustrate these points.
Conclusions: The VAST provides a reliable research and clinical tool for the assessment of comprehension and production of verbs and sentences, and gives clear directions for treatment.

The Verb and Sentence Test (VAST) has been developed to enable clinicians and researchers to investigate disorders affecting the production and comprehension of verbs and sentences. This new test battery fills a gap. Although interesting and useful diagnostic materials are used for clinical and research purposes (e.g., Druks & Masterson, 2000; Marshall, Black, & Byng, 1998; Whitworth, 1995), there are few linguistically motivated published tests designed to assess verb and sentence processing. There are now a number of papers reporting on empirical studies that focus on verb and sentence deficits. Some of these include materials used, but these publications are not readily available for clinicians. The development of this test was motivated by such studies.

The test consists of ten tasks from which one or more can be selected to investigate the nature of the language problems that a person displays. The VAST may be used to establish baselines by which language change or the effectiveness of therapy can be calibrated, and to motivate therapy. Although the test was designed to be used with people with aphasia, it can be used with other populations. The VAST is an adaptation of

Address correspondence to: Roelien Bastiaanse, University of Groningen, Dept. of Linguistics, P.O. Box 716, 9700 AS Groningen, The Netherlands. Email: y.r.m.bastiaanse@let.rug.nl

http://www.tandf.co.uk/journals/pp/02687038.html DOI:10.1080/02687030244000455

the Dutch test battery *Werkwooden- en Zinnentest: WEZT* (Bastiaanse, Maas, & Rispens, 2000). The VAST and the WEZT are based on the same model of verb and sentence processing, and the nature of the tasks is similar in both. However, differences between Dutch and English have led to some modifications. Certain items have been omitted and some have been added. In the Dutch version, for example, attention is given to verb movement, a linguistic operation that does not have the same consequences for surface forms in English and is therefore not included in the English version. Both the Dutch and the English versions of the test have been standardised (using non-aphasic and aphasic subjects), and checked for validity and internal consistency.

In developing the test, our goal has been to devise a test battery that can be used to assess verb and sentence processing, and to ensure that this battery; (a) makes use of and provides theoretically motivated linguistic insights, (b) is clinically relevant, and (c) can be used for people with different types of aphasia.

The first aim was to provide the examiner with linguistic insights about certain features of aphasia. In order to achieve this, we have ensured that all tasks in the test focus on important linguistic processes and that plausible explanations for deficits associated with these processes can be found in the research literature. For example, there are many reports on investigations into the difficulty aphasic speakers have with reversible sentences (such as *the man saves the woman; the woman is saved by the man*). There are detailed descriptions of this type of impairment and various explanations as to why these sentences are difficult for some aphasic speakers to process (see for instance, Berndt, Mitchum, Haendiges, & Sandson, 1997b; Grodzinsky, 1995). Tasks have been included in this test that allow this phenomenon to be investigated. The test, therefore, reflects the current state of knowledge in a dynamic research field, but as understanding and perceptions of the disorder change, we expect that it will be necessary to add to the battery as our knowledge of aphasia expands.

The second aim was to develop a test that not only gives insights into the underlying impairment, but can also be used to motivate therapy. All the tasks in the VAST can be related to therapy that is either described or discussed in the aphasia literature. So, taking the previous example of reversible sentences, we can find various studies that have used the concept of ''mapping'' between the semantic and the syntactic domain to address problems of sentence comprehension (see for an overview, Marshall, 1995). The publication of these studies has ensured that we include tests to investigate whether an aphasic speaker has problems with reversible sentences. Not all characteristics of aphasia have been so fully explored. We have not included tasks that assess features of aphasia if there is no associated research. We wanted only to incorporate tasks that investigate phenomena for which not only background research but also therapy programmes exist. As a consequence, we have omitted tests probing a number of frequently observed aphasic features. For example, negation is difficult for aphasic speakers to process and there have been some studies published in this area; however, to date no therapy programmes exist. So, keeping to our aims, no task for negation has been included.

The third aim was to devise a test that could be used with a fairly wide aphasic population. This test is not intended to be used with any one type of aphasia specifically, as a substantial proportion of people with aphasia are not clinically diagnosed as having one of the classic syndromes. Deficits in sentence construction and comprehension are known to be characteristic of Broca's aphasia but can also be found in speakers with Wernicke's aphasia and other types of aphasia. It will be found that this test provides a way of testing a wide range of patients in a systematic and comprehensive manner, regardless of aphasic syndrome.

We do not intend the VAST to replace existing tests, but we are confident it will complement a range of other assessment materials. Two of the most frequently used assessments are the Boston Diagnostic Aphasia Examination: BDAE (Goodglass & Kaplan, 1983) and the Psycholinguistic Assessment of Language Processing in Aphasia: PALPA (Kay, Lesser, & Coltheart, 1992). The BDAE is widely used for clinical and experimental purposes, especially outside the UK. The aim of the BDAE is to diagnose the type and severity of aphasia exhibited across language modalities. A diagnosis based on the classical syndromes of Broca's aphasia, Wernicke's aphasia, conduction aphasia, and so on may be revealed, but the test does not aim to reveal the underlying nature of the aphasia deficits. So, for example, one may ascertain that a patient has problems with naming but not whether the deficit arises from the semantic or phonological level of processing. In contrast to this, the PALPA does seek to pinpoint the level of breakdown in a deficit. However, the motivating theoretical model and the majority of the tasks in this test focus on phonological and semantic characteristics of nouns. There is scant attention to sentence processing and the PALPA does not provide tasks to investigate verbs. More recently, materials have started to appear that do permit the investigation of verbs and sentences and seek to find psycholinguistic explanations for deficits found in these domains (e.g., Druks & Masterson, 2000; Marshall et al., 1998). However, none of the published tests or materials to date covers the features investigated by the VAST and, we contend, they can be seen as complementary rather than competitive.

An article that was influential during the development of the original battery is that written by Schwartz, Fink, and Saffran (1995). They distinguish three processes that are important in the comprehension and production of sentences: (1) recognising or retrieving the verb with all the information regarding meaning, associated thematic roles, and argument structure; (2) forming a grammatical structure; (3) mapping the grammatical roles onto the semantic roles. Each of these three processes can be investigated with tasks within the VAST.

In this paper we will focus on several aspects of the VAST. First a neurolinguistic framework of the VAST will be given in which deficits in the comprehension and production of verbs and sentences are described. We will then provide a brief outline of the test, followed by two case studies which illustrate how the results on the different tasks can be used for treatment. Finally we will present statistical information about standardisation.

NEUROLINGUISTIC FRAMEWORK

Verb deficits

Verbs play an important role in language: they not only carry lexical meaning, but they also determine the linguistic environment in which they may occur: verbs specify the number of arguments (argument structure) and the kind of phrasal categories that may follow the verb (subcategorisation). For example, the verb *repair* specifies that two arguments are involved (one who repairs and something that is being repaired) and that the argument following the verb needs to be an NP that may be followed by an adjunct PP (see sentence 1a–1b):

(1) a. John repairs the car in the garage
    b. *[1] John repairs in the garage

[1] Following linguistic convention, the asterisk is used as a marker of ungrammaticality.

Relative to nouns, little is known about the range and the nature of verb deficits in aphasia although this is a growing area of research. Some researchers have found that individuals with Broca's aphasia are better at retrieving nouns than verbs, in contrast to Wernicke's patients who show the reverse (cf. Berndt et al., 1997a/b; Miceli, Silveri, Villa, & Caramazza, 1984; Zingeser & Berndt, 1988). Other studies report that fluent aphasic people perform similarly on naming objects and actions (Basso, Razzano, Faglioni, & Zanobio, 1990) or that they are better at retrieving nouns compared to verbs (Jonkers & Bastiaanse, 1996; Kohn, Lorch, & Pearson, 1989; Williams & Canter, 1987). The first two research groups have pointed out that the results of studies on verb processing may be different due to the fact that a number of linguistic factors need to be controlled for when selecting test items. Breedin, Saffran, and Schwartz (1998) have looked at factors in verb retrieval and found, contrary to what might be predicted, that low-frequency verbs were easier than high-frequency verbs. Jonkers and Bastiaanse (1996) show that transitivity and name relatedness with a noun influence naming actions much more than does word frequency, which is generally the only variable that researchers have taken into account when designing experimental materials.

The ability to name actions is not necessarily related to verb retrieval within sentential context, which is a better approximation of verb use in daily life (cf. Jonkers, 2000). Different aspects come into play when verbs need to be used within a sentence; a verb may be produced either in its finite form (inflected, for example, for tense and agreement) or as an infinitive. Bastiaanse and Van Zonneveld (1998) have investigated verb inflection in Dutch people with Broca's aphasia and found that the ability to retrieve verbs in a sentence depends on the position in the sentence. Fluent aphasic patients may also experience problems with verb inflection (see Bastiaanse & Edwards, 2001). Furthermore, spontaneous speech studies show that almost all fluent aphasic speakers have problems using verbs; they may use fewer verbs than healthy speakers and/or the diversity of the produced verbs is lower (Bastiaanse, Edwards, & Kiss, 1996; Edwards & Bastiaanse, 1998).

The tasks of this test battery assess aspects of verb processing both at the word and sentence level. The production tasks differentiate between eliciting finite and nonfinite verb forms. All test items have been matched on transitivity, thematic structure, name relatedness with a noun, and word frequency, as these factors can influence the ability to retrieve/comprehend verbs. The VAST has been constructed so that the examiner can investigate all or some of these factors, depending on the type of investigation or the patient's needs.

Sentence comprehension deficits

Failure to understand a sentence can take different forms; it may be that aphasic patients do not understand the meaning of the words or some of the words in a sentence. Other patients may have difficulty with interpreting word order. This is noticeable in semantically reversible sentences, as the plausibility of this kind of sentence is not affected by changing the order of the thematic roles, the agent and the theme. This is in contrast with irreversible sentences: if a patient has difficulty with word order information s/he can deduce the meaning of the irreversible sentences on the basis of general world knowledge. For example, the thematic roles of the sentence *the girl reads a book* can be interpreted based on the knowledge that books cannot read girls. However, a sentence such as *the horse kicks the cow* retains a plausible interpretation when one changes the order of the thematic roles: *the cow kicks the horse*. In the latter kind of

sentence, world knowledge cannot be used to infer ''who is doing what to whom''; only processing the right word order leads to correct understanding of the sentence. If patients suffer from a severe grammatical comprehension deficit, an active reversible sentence (such as *the horse kicks the cow*) may be misunderstood. In the case of a less severe disorder, grammatically complex sentences (such as passives and object-cleft sentences) in which the orders of the thematic roles differ from the more frequent one (agent-verb-theme) are prone to misinterpretation. There is an ongoing debate in the literature about the theoretical analysis of this disorder observed in agrammatic people with Broca's aphasia. Some researchers claim that the comprehension deficit of semantically reversible sentences, in which the NPs have been moved out of their original positions (such as in passives and in object-cleft sentences), results from deleted traces (cf. Grodzinsky, 1995, 2000). Other researchers suggest that the deficit in interpreting word order stems from a problem in ''mapping'' the thematic roles onto the grammatical roles (cf. Marshall, 1995; Schwartz, Saffran, Fink, Myers, & Martin, 1994).

Even though comprehension of grammatically complex sentences has been studied extensively in Broca's aphasia, fluent patients may also have difficulty interpreting this type of structure. Caramazza and Zurif (1976) have shown that individuals with Wernicke's aphasia have problems with understanding passive sentences on a pointing-to-picture task. The performance pattern is, however, different from that of people with Broca's aphasia. Whereas the latter pointed most frequently to the distractor picture that displayed the same action but with reversed thematic roles, the group of Wernicke's patients showed no clear error pattern. This suggests that the comprehension problems of the fluent patients originate from a lexical-semantic deficit rather than from a grammatical deficit. Other researchers have found that some fluent subjects with aphasia may be more likely to select the reversed role distractor (Bastiaanse & Edwards, 2001; Luketela, Shankweiler, & Crain, 1995). With these aphasic performance patterns in mind, we have developed a sentence comprehension task (a pointing-to-picture design), testing semantically reversible sentences with different word orders (for English: actives, passives, object and subject-cleft sentences) including lexical-semantic distractors, thematic role reversal distractors, and a combination of lexical-semantic and thematic role reversal distractor pictures. These three types of error distractors allow the examiner to explore the nature of the deficit. For example, a tendency to select the lexical distractor suggests a lexical deficit whereas a tendency to select the reversed role distractor suggests a syntactic or a mapping deficit.

Both fluent and non-fluent patients may also have trouble with judging the grammaticality of certain syntactic structures (cf. Balogh & Grodzinsky, 2000; Grodzinsky & Finkel, 1998; Linebarger, Schwartz, & Saffran, 1983), especially with respect to judging word order. Detailed investigations have shown that some patients are able to judge a sentence correctly on its grammaticality, even though they do not understand the sentence. The dissociation between sentence comprehension and the ability of judging a sentence on its grammaticality has been taken into account by incorporating a grammaticality judgement task (assessing sensitivity to word order) in the test battery.

Sentence production deficits

Producing a sentence not only entails retrieving the lexical items, but also linking the thematic roles to the grammatical roles. For instance, in the sentence *the girl eats a biscuit*, the thematic role of agent needs to be mapped onto the grammatical role subject

(*the girl*) and the thematic role of theme has to be mapped onto the grammatical role direct object (*the biscuit*). A final step in the process of sentence production is placing the words in the right order and inserting grammatical morphemes (for example to express subject–verb agreement). Difficulties can arise in any of the stages involved in sentence production; the VAST therefore contains several tasks to assess these steps. It has been demonstrated that grammatical deficits lead to disturbances within the production process. The majority of studies focus on Broca's aphasic patients, who tend to omit thematic roles (Schwartz et al., 1994), or use verbs that carry few grammatical roles (Bastiaanse & Jonkers, 1998; Byng, 1988; Thompson et al., 1997). These patients furthermore seem to opt for ''simple'' syntactic structures, such as subject–verb clauses. Experimental studies have demonstrated that individuals with Broca's aphasia have difficulties with producing more complex grammatical structures, such as relative clauses, passives, and questions. The nature of the deficit is controversial; several strong theoretical explanations have been formulated (see e.g., Bastiaanse & Van Zonneveld, 1998; Friedmann & Grodzinsky, 1997; Hagiwara, 1995; Schwartz et al., 1995).

People with fluent aphasia may also have problems with constructing sentences. Their severe word retrieval deficit seems to play a role in this. According to some researchers, paragrammatical utterances (typical of the speech of fluent patients) are the result of problems with the ''control'' process (Butterworth & Howard, 1987; Butterworth, Pazeri, Semenza, & Ferreri, 1990) or a lexical retrieval problem (Bird & Franklin, 1996). Others suggest that there are also grammatical problems not related to the lexical deficit, impacting on the ability to produce sentences (cf. Edwards, 2000; Edwards & Bastiaanse, 1998; Niemi, 1990).

DESCRIPTION OF THE TASKS

Each task starts with examples that illustrate the nature of the task and can be used to check whether the subject has understood the instruction. All the verbs in the test have been controlled for frequency using the Francis and Kucera corpus (1982). It is important to note that, although the factor ''frequency'' is recognised as influential in the field of psycholinguistics, it is not agreed where the border between ''high'' and ''low'' frequency lies. Further, the use of various corpora may be questionable. For example, the frequency values in this test come from a corpus widely used, yet it is based on written language. Whether the frequencies we have used are applicable to spoken language is not clear. The verbs have been controlled for transitivity (the verb can take one or two arguments), reversibility, and name relatedness with a noun. The latter means that the verb stem is identical to the noun that is also in the picture, e.g., (to) *cycle*, in tasks in which these factors are assumed to play a role. It can be calculated on the score forms whether these linguistic variables play a role in the performance of the subject (for instance, low-frequency verbs may be harder to retrieve compared to high-frequency verbs). The majority of the *nouns* in the sentences have a high frequency and are highly imageable; however, the tasks using written language (sentence anagram tasks) also incorporate words with a lower frequency allowing a larger variety of words, which makes the test more attractive for subjects.

Comprehension

Comprehending a sentence requires grasping the meaning of the lexical items, including the verb, and interpreting the meaning portrayed by word order. The VAST contains tasks that examine both processes.

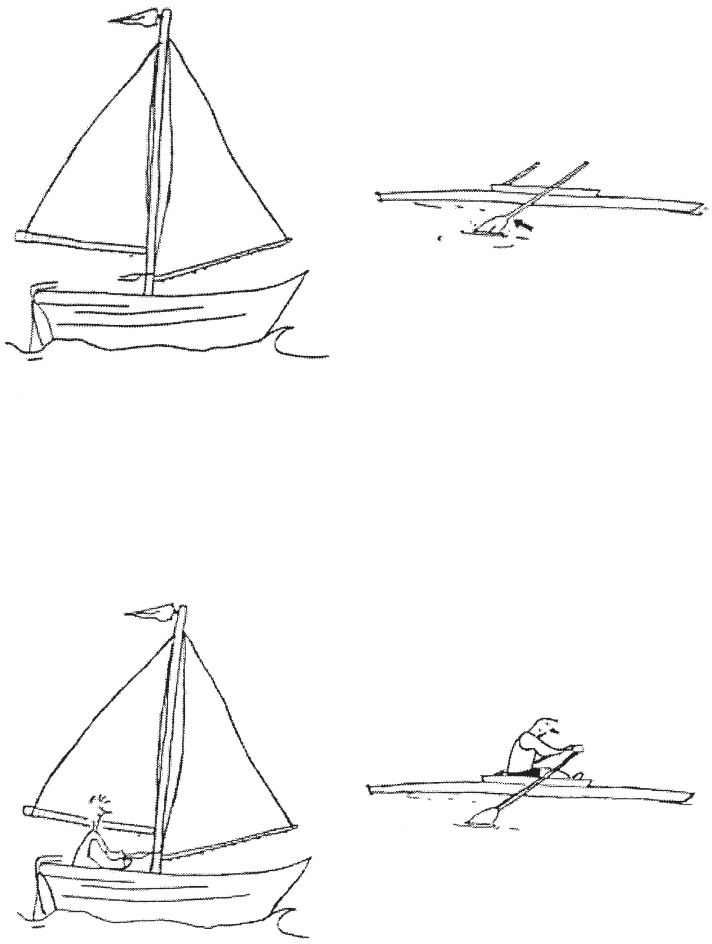


Figure 1. Example of the verb comprehension task; target: *rowing* (bottom right), distractors: *sailing* (bottom left), *oar* (top right), and *boat* (top left).

Verb comprehension. This task investigates the ability to comprehend single verbs. The subject is presented with four pictures and the examiner reads a verb aloud; the subject is asked to point to the one picture from an array of four that matches the spoken word. The three distractor pictures represent an object that has a close semantic relation to the target verb (e.g., target: *biting*, closely related noun distractor: *teeth*); an action that is related to the target action (e.g., target: *biting*, related action distractor: *scratching*); an object that is related to the action distractor (e.g., target: *biting*, noun distractor related to action distractor: *nails*). The 40 items are controlled for frequency, transitivity, and name relatedness with a noun. All these features are indicated on the score form. Figure 1 presents an example of this task.

Sentence comprehension. In this task, sentences containing moved constituents as in passives (theme, verb, agent) and object-clefts (theme, agent, verb) have been included, together with sentences in which the order of the thematic roles is canonical as in actives and subject-cleft constructions (agent, verb, theme). These sentence types allow the

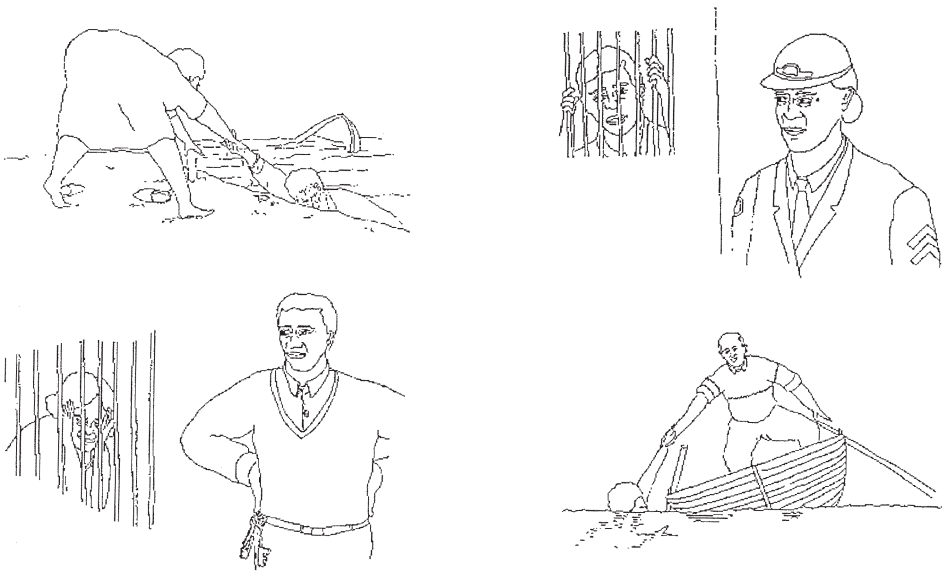


Figure 2. Example of the sentence comprehension task; target *the woman is saved by the man* (bottom right), distractors: *the woman saves the man* (top left), *the man guards the woman* (bottom left), and *the woman guards the man* (top right).

examiner to investigate whether the order of the thematic roles influences sentence comprehension. The procedure used is one of picture selection. The subject is shown four pictures while the examiner reads a sentence aloud; the subject is asked to point to the picture matching the sentence. There are three types of distractors: a picture in which the action and participants are the same but the thematic roles are reversed (e.g., target: *the cow kicks the horse*, reversed roles distractor: *the horse kicks the cow*); a picture in which a different action is depicted (e.g., target: *the cow kicks the horse*, lexical distractor*: the cow bites the horse*); a picture in which both the thematic roles are reversed and in which the action is different (e.g., target: *the cow kicks the horse*, reversed roles/lexical distractor: *the horse bites the cow*). This format allows the examiner to determine what kind of errors the subject makes (lexical errors/role reversals or a combination of both) and in which sentence types these occur. The task includes 40 items; 10 for each sentence type. An example of an item is given in Figure 2.

Grammaticality judgement. Misinterpretation of reversible sentences may originate from a problem with parsing the grammatical structure, or from a difficulty with mapping the thematic roles onto the arguments. Studies have shown that aphasic people who are disturbed in understanding reversible sentences are able to judge sentences on various types of syntactic violations (Linebarger et al., 1983; Schwartz, Linebarger, Saffran, & Pate, 1987), indicating that the comprehension deficit originates from a difficulty with thematic roles, rather than from a grammatical problem. This task investigates whether an aphasic speaker is able to parse a sentence, information that is important for planning therapy especially when the comprehension task shows that the aphasic patient has difficulties understanding reversible sentences. Only irreversible sentences are tested as they can be judged correctly without having to map thematic roles onto the arguments if one has access to the grammatical structure. An example can clarify this assumption. The

sentence **the woman is baked by the cake* has the phrasal structure NP V PP which is correct for *bake.* However, *bake* is specified as having the meaning *to prepare food in an oven* and as selecting an agent (the person baking) and a theme (the food undergoing the action). A person with intact parsing abilities can judge this sentence as incorrect, because s/he will reject the order of agent (animate)-Verb-Theme (inanimate) in this particular passive sentence.

In this task, the examiner reads aloud the sentence and asks the patient to indicate whether the sentence is ''good'' or ''bad''. The task starts with a detailed introduction and with four examples. The task contains 40 irreversible sentences of which 20 are grammatical and 20 are ungrammatical. Each group contains four different types of sentences (five actives, five passives, five object-clefts, and five subject-clefts) so that the influence of the order of thematic roles on the patient's ability to judge a sentence can be determined.

Integration of comprehension tasks. An insight into comprehension abilities can be gained by comparing the performances (in a qualitative and quantitative manner) on the different tasks. If a subject, for example, has difficulties with the Verb Comprehension task and frequently points to the picture representing the lexical distractor in the Sentence Comprehension task, one can conclude that the comprehension problems stem from a lexically based deficit. However, it is not always the case that such a deficit will result in a low performance on the Verb Comprehension task. A lexical-semantic deficit may surface only due to the extra demand of processing grammatical information in the Sentence Comprehension task.

Other patients may not have difficulties at the single word level but will have poor comprehension of reversible sentences. By comparing the results from the comprehension test and grammaticality judgement, the examiner can estimate whether possible problems with understanding thematic roles in reversible sentences stem from difficulties in processing grammatical information or mapping. The latter is important with respect to the type of therapy: if a patient is not sensitive to the correct order of constituents, one will not be able to assign a meaning to a sentence using the word order information. If a patient shows intact parsing abilities, a mapping deficit is likely to be the *crux* of the problem.

Production

In order to produce a sentence, one has to retrieve the different content words, including the verb from the lexicon, and form a grammatical structure. The production part of the VAST evaluates the ability to retrieve verbs from the lexicon, to use them in sentences, and to form canonical and noncanonical sentences, including *wh*-questions.

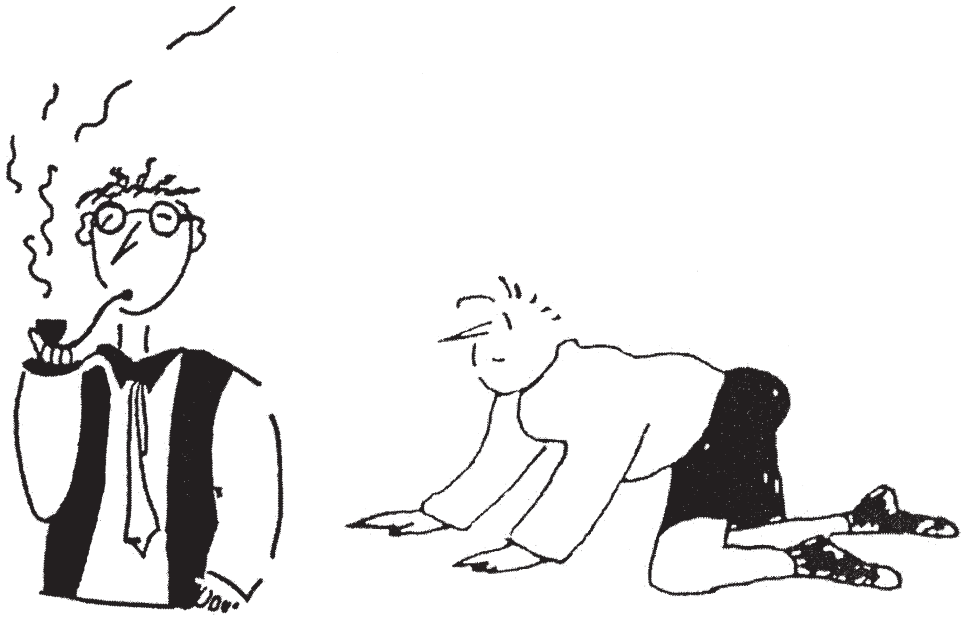
Action naming. Several studies have shown that a number of factors, such as word frequency, transitivity and name relatedness with a noun, are influential on verb retrieval in aphasia, depending on the type of aphasia. This task, Action Naming, can be used to evaluate the influence of these factors. The subject is presented with a picture and is asked to describe in one word what is happening in that picture. The test contains 40 items that are all agentive verbs, meaning that they select the thematic role of agent in case of an intransitive verb, and agent and theme in case of a transitive verb. Figure 3 shows two examples of items from this task.

Figure 3. Two examples of the action naming task; targets *painting* and *picking*.

Filling in finite verbs and infinitives in sentences. It is known that for some aphasic people a sentence framework facilitates verb retrieval, whereas for others sentential context has a detrimental effect on verb retrieval. Additionally, some aphasic speakers will have more trouble using finite verbs than infinitives. This task provides the opportunity to investigate these factors and can be viewed as a step between retrieval of verbs as single words and constructing a sentence. This task comprises two sets of sentences: 10 sentences in which the verb needs to be finite (e.g., *the grandfather smokes a pipe*) and 10 sentences that require verbs which are infinitives (e.g., *the boy wants to crawl to his mum*); see Figure 4. The subject is presented with a picture that has a sentence printed underneath in which the main verb is missing. The experimenter reads aloud that sentence and ''hums'' three syllables at the place of the verb. The subject is asked to say the missing word. Information on frequency and transitivity is given for each verb. The nouns that are used are all of high frequency to minimise interference with comprehension problems.

Sentence construction. Giving an oral description of a picture as in this task is one of the best ways to estimate the ability to make sentences in daily life. The responses on this task can be analysed on the success of retrieving lexical items and constructing grammatical sentences, because one has a good idea of the target sentence, which is not always the case in spontaneous speech. Of course the responses also allow for an evaluation of the use of word types such as prepositions, determiners, auxiliaries, and of bound grammatical morphemes marking tense and agreement. It permits the examiner to note and quantify, if desired, the occurrence of paraphasias and other error types.The 20 items are controlled for three factors: frequency (all verbs are of high frequency), transitivity (10 transitive and 10 intransitive verbs), and reversibility of thematic roles (5 irreversible and 5 reversible sentences). A picture is presented to the subject who is asked to describe that picture in one sentence. In Figure 5, two examples of this task are given.

Sentence anagrams with pictures. Even though a sentence construction task, such as the one just described, is a good tool for investigating sentence production, it also has



Filling in finite verbs.
The man ... a pipe

Filling in infinitives
The child wants to ... to his mum

Figure 4. Examples of filling in finite verbs (left; target *smokes*) and infinitives (right; target *crawl*).

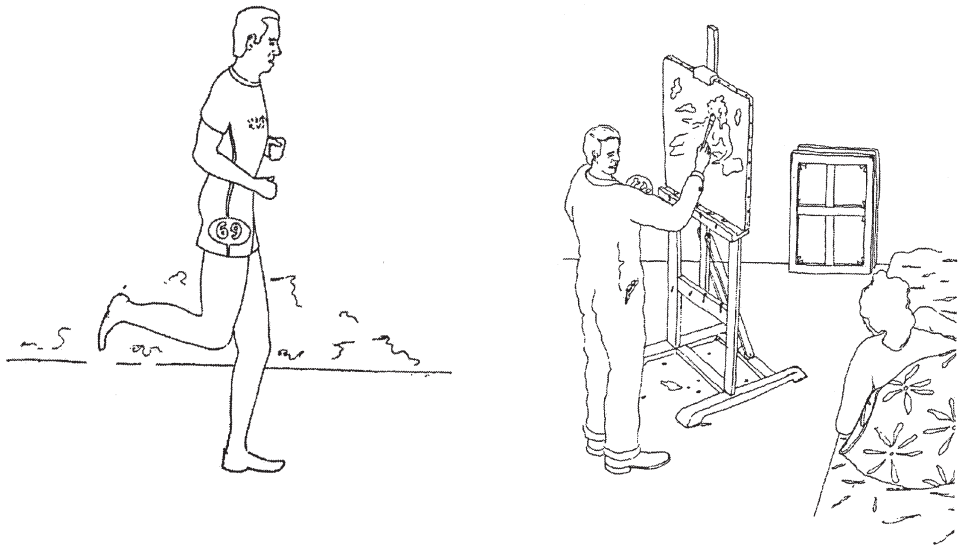


Figure 5. Two examples of the sentence construction task; targets *the man runs* and *the man paints the woman*.

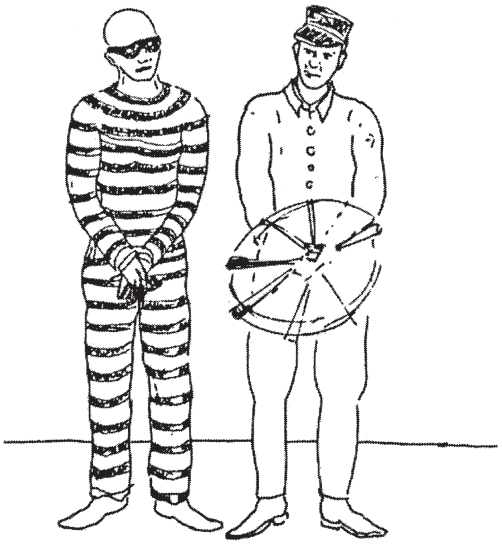


Figure 6. Example of the sentence anagram task with pictures; target *the thief is guarded by the policeman*.

some limitations. First of all, it is rather difficult to score the performance of a patient systematically. Second, aphasia may be accompanied by dysarthria or dyspraxia of speech that compromises speech production. Furthermore, it is not easy to elicit grammatical structures other than simple actives via a picture description task. Therefore, two anagram tasks have been included in the VAST to gain insight into the grammatical abilities of an aphasic speaker. In the Sentence Anagram with pictures task the 20 items consist of 10 active and 10 passive sentences, of which 10 are reversible and 10 are non-reversible sentences. The subject is presented with a picture and three cards, each of which has a sentence constituent printed on it (e.g., an active sentence: *the boy / kisses / the girl*, a passive: *the girl / is kissed by / the boy*). The subject is asked to use these cards to form a sentence that matches the picture. An example is given in Figure 6. The score forms provide ample space to write down how the subject forms the sentences, e.g., do they self-correct having read their attempt at sentence assembling.

Sentence anagrams without pictures. This task has been included for the same reasons as just described on special request of speech and language therapists, as it has been found that some aphasic people perform differently when the sentences do not have to match pictures. In this task only 20 irreversible sentences have been included of which 10 are active and ten are passive. The subject is presented with three cards with constituents printed on them and is asked to arrange the cards to form a sentence. Examples of sentences are: *the bike / is fixed by / the man* and *the child / throws / the ball*.

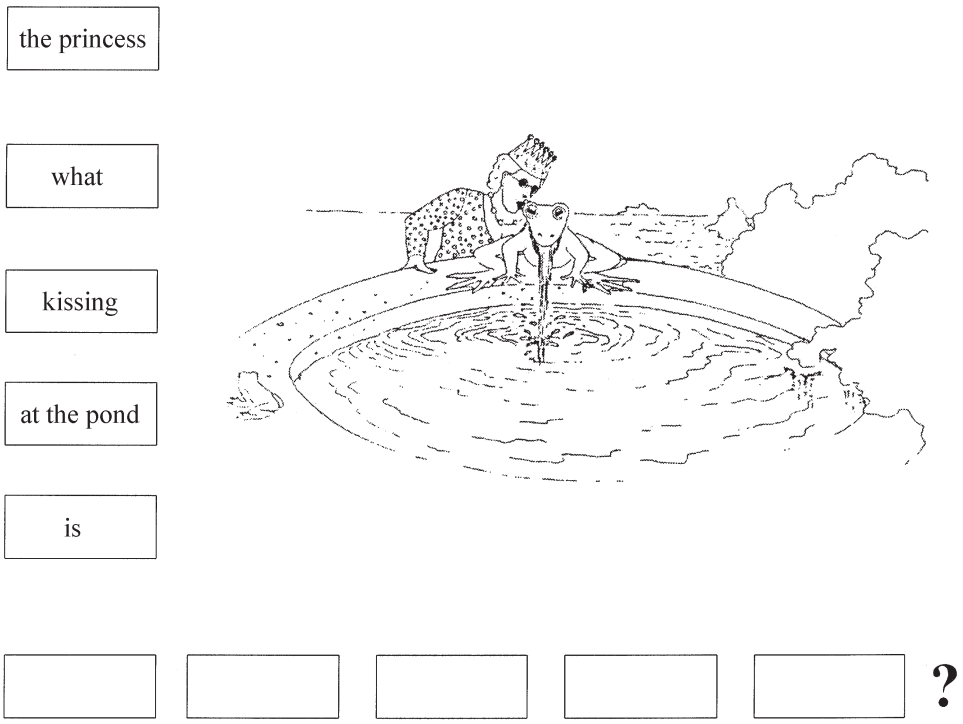


Figure 7. Example of the *wh*-anagrams; target *what is the princess kissing at the pond?*

Wh-anagrams. Aphasic people may have difficulty forming questions, a difficulty that interferes with their communicative ability in daily life. Thompson et al. (1996) have studied this in agrammatic aphasia and describe a treatment programme based on linguistic principles. There is no published test available that investigates the ability to produce questions and therefore this task has been developed. It is difficult to elicit questions orally in a structured way, so anagrams are being used. Thompson et al. (1996) describe two types of questions: constructions in which the *wh*-word represents an NP (*who* and *what* questions), and constructions in which the *wh*-question word represents a PP (*where* and *when*). The former structure is derived by argument movement, whereas the latter is an adjunct transformation. Thompson et al. (1996) have found that this linguistic difference is important with regard to therapy and therefore the two types of questions are distinguished in this task. Twenty items are included in this task, five items for each *wh*-question word (*who*, *what*, *where*, and *when*). As with the other sentence anagram tasks, the examiner shows the subject a picture and presents the subject with five cards containing the sentence constituents (e.g., *what / is / the princess / kissing / at the pond /*; see Figure 7). The subject is asked to arrange the cards so that a question is formed that matches the picture.

Integration of production tasks. The Sentence Construction task plays a central role in the set of production tasks. The performance on this task reflects the ability to produce sentences in daily life. The results on the other tasks will help the examiner to evaluate the nature of the difficulties that people with aphasia may experience when they are producing sentences. The Action Naming task investigates whether a subject is able to retrieve a verb. In addition to this, with the task for using infinitives in sentences one can

test whether providing a sentence framework in which a subject needs to retrieve a verb, influences the performance. One can also examine the effect of finiteness on verb retrieval with the Filling in Verbs in Sentences task. Some aphasic individuals make more paraphasic errors when they need to inflect the verb, whereas others make inflectional errors. The Sentence Anagram tasks investigate the ability to form complex grammatical structures such as passives and questions. It is important to differentiate between active and passive structures, reversible and irreversible sentences and *who*/*what* and *where*/*when* question words in order to plan effective therapy.

In all, during the analyses of the results one needs to consider the following questions:

- Is the subject able to retrieve the correct verb?
- Is the subject able to inflect the verb correctly?
- Is the subject able to produce/form sentences in which constituents have been moved out of their canonical order (the passives, object-cleft sentences, and *wh*-questions)?
- What kind of difficulties does the subject experience when s/he needs to produce a sentence without any help?

The answers to these questions motivate the planning of therapy. Later, two case studies will be described to demonstrate how the information provided by the tasks of the VAST can be used in treatment.

DESIGNING AND STANDARDISING THE VAST

If one wishes to design a new test, there are several points that need to be considered. First of all, the new test should contribute something to the existing materials. Publishing a new test on object naming is not very useful, as both the Boston Diagnostic Aphasia Examination (BDAE, Goodglass & Kaplan, 1983) and the PALPA (Kay et al., 1992) contain sufficient excellent materials for object naming. The VAST contributes to the assessment of language disorders, because linguistic concepts are addressed that do not appear in other tests, such as production of verbs in sentences, comprehension of verbs, and the construction of non-canonical sentences (passives, object-clefts, and questions), which are known to be difficult for aphasic people.

Establishing norms for the Dutch and English versions

A test for language disorders is of course for use with people with language disorders, therefore people without language disorders should be able to perform faultlessly on such a test. To guarantee this, the construction of the VAST took several stages. For the original Dutch test, the first version was tested on 50 non-brain-damaged speakers, varying in age, gender, and educational level. The results demonstrated that some items and pictures were not clear and these were removed. As in all tasks items were matched on various variables (e.g., frequency, name-relatedness, transitivity), the matched items were omitted as well to keep the number of items even. On the basis of these results the final version of the Dutch version was made, in which all remaining items were still controlled for the relevant factors. Only items that were performed correctly by at least 90% of the non-brain-damaged subjects were retained. The final version was presented to a specially selected group of 40 non-brain-damaged speakers, a group of 35 speakers with aphasia, and 6 non-aphasic speakers with a lesion in the right hemisphere, who were living in different parts of The Netherlands. The latter group was tested to ensure that the errors made by the aphasic speakers were due to aphasia and not to brain damage as such.

The experimental versions of the Dutch and English test contained an additional task, a multiple choice task that required the selection of the appropriate question word (*who, what, where*, and *when*) in a sentence. This was a very easy task for the non-aphasic speakers. When we tested the aphasic speakers, it proved to be incomprehensible for them. It was not too difficult, but the examiners were not able to explain to the aphasic subjects what the actual goal of the task was. It was therefore decided to remove this task.

The English version was developed from a translation/adaptation of the Dutch version. Non-translatable items were removed, together with the items with which they were matched. Therefore, the Verb Comprehension and Action Naming tests contain fewer items than the Dutch version. The test for grammaticality judgement was shortened, as English allows for fewer word orders than Dutch. Sentence Construction and all anagrams tasks are the same as in Dutch (except for one item of the anagram task with pictures), although the anagram task for *wh*-questions has one extra card for the auxiliary that is not used in Dutch.

Controls

In order to acquire norms for the English version, 80 non-brain-damaged speakers were tested. One subject's data have been removed; she was a 78-year-old lady, who made many more errors than her peers although there was no other evidence of cognitive deterioration at the time of testing. A year later she demonstrated clear signs of dementia.

Not all subjects were presented with each task, but between 20 and 34 subjects performed each task. Most controls reached ceiling levels. As no important differences were found for the Dutch version regarding age, gender, and education, these variables were not controlled for in the non-brain-damaged English subject group. As these subjects obtained ceiling effects, this decision was justified post-hoc. The demographic data are given in Tables 1 and 2 and the means, standard deviations, ranges, and the numbers of healthy speakers that were tested on each task are given in the Table 3.

Aphasic speakers

We tested 25 aphasic individuals, who were not selected for aphasia type or severity. Again not every aphasic subject was presented with all tasks. The sentence construction test was presented to 16 aphasic subjects; the filling in of finite and non-finite verbs was conducted with 19 aphasic speakers; at least 20 persons with aphasia did all the other tests. There were several inclusion criteria for aphasic speakers: the aphasia should be the result of one single lesion in the left hemisphere, subjects should be at least 2 months post-onset, and there should be no concomitant cognitive disorders (such as a visual or attentional impairments) that might influence the results. The data on age, gender, years of education, and time post-onset are given in Tables 1 and 2. As can be seen, aphasic and non-aphasic subjects were not matched on these variables, as the Dutch data had already revealed that there were no effects for either variable. The group of aphasic speakers scored significantly lower on all tasks than the non-brain-damaged subjects. The statistics are given in Table 3.

Reliability

In order for a test to be reliable, there should be a high internal consistency. The analysis used Cronbach's α, which is based on item variance, and the results obtained show a high internal consistency. In Table 4 the indices are given for all tasks. They are all acceptable

TABLE 1
Number and gender distribution for both subgroups

	Number	*Male–Female*
Aphasic	25	16–9
Control	79	31–48

TABLE 2
Mean, standard deviation (sdv), and range for age, years of education, for the control and aphasic subjects, and months post-set for the aphasic subjects

	Age	*Years education*	*Months post-onset*
aphasic			
Mean	68.40	11.60	40.00
Sdv	16.08	1.87	55.10
Range	54–84	8–15	2–257
control			
Mean	55.57	13.55	
Sdv	8.32	2.93	
Range	25–88	8–22	

and where the value is over 0.90, very acceptable. The analysis was done for the tasks containing 20 items or more. The tasks of supplying finite verbs and infinitives comprise 10 items each and were therefore not included in this analysis.

Validity

As there are no English tests that evaluate linguistic processing abilities in a comparable way, it is difficult to establish the validity of the individual tasks of the VAST. For this reason, the severity of aphasia was chosen as a focus for demonstration of validity. The Token Test from the Aachen Aphasia Test (English version; see Miller, De Bleser, & Willmes, 2000) was selected as an appropriate measure in this regard, as this version of the Token Test (Orgass, 1976) is a good measure of severity in aphasia (Huber, Poeck, & Willmes, 1984). Both the Token Test and the VAST were presented to 16 aphasic subjects and correlations were used to evaluate validity. If a significant correlation was found between the Token Test score and the score on a task of the VAST, this task was assumed to be valid. The Token Test is generally accepted as a suitable test to establish the severity of aphasia, although it is still unclear why this is the case. We expected all tasks to have a significant correlation with the Token Test, implying that for each task a lower score would reflect a more severe deficit than a higher score. The number of *correct* answers on the tasks of the VAST was correlated with the number of incorrect answers on the Token Test, corrected for age. Therefore, negative correlations are expected to be found.

All tasks correlated negatively with the Token Test (see Table 5), but not all correlations are significant at the .05 level. For Verb Comprehension, there is a tendency to significance ($p < .10$). The correlation for Sentence Construction is not significant at

TABLE 3
Means, standard deviations (sdv), and ranges of the aphasic patients and the non-brain-damaged control subjects

	Verb comprehension	*Sentence comprehension*	*Grammaticality judgement*	*Action naming*	*Verb infinitive*	*Verb finite*	*Anagram −picture*	*Anagram +picture*	*Sentence construction*	wh-*questions*
Aphasic										
Number	25	25	24	24	19	19	24	25	16	20
Mean	34.80	29.00	30.67	22.04	6.47	3.21	15.17	14.08	10.50	10.00
Sdv	5.23	7.17	7.51	10.66	2.78	3.24	4.56	5.41	7.43	7.66
Range	17–40	18–39	19–40	1–38	1–10	0–10	6–20	1–20	0–20	0–20
Control										
Number	23	20	34	20	20	20	24	24	27	20
Mean	39.70	39.90	39.68	38.80	9.65	9.80	20	20	19.78	19.55
Sdv	0.56	0.31	0.77	1.20	0.59	0.52	–	–	0.80	0.83
Range	38–40	39–40	37–40	37–40	8–10	8–10	20–20	20–20	16–20	17–20
Max. score	40	40	40	40	10	10	20	20	20	20

''Number'' refers to the number of subjects who did the task.

TABLE 4
Reliability indices for the VAST

Tasks	*Cronbach's α index*
Single verb comprehension	0.78
Sentence comprehension	0.89
Grammaticality judgements	0.89
Action naming	0.90
Sentence construction	0.85
Anagrams without pictures	0.89
Anagrams with pictures	0.90
Wh-anagrams	0.95

TABLE 5
Correlations between the tasks and the Token Test

Tasks	*r*	*p*
Verb comprehension	−0.41	$0.05 < p < .10$
Sentence comprehension	−0.71	**< .001**
Grammaticality judgement	−0.47	**< .05**
Action naming	−0.58	**< .01**
Infinitives in sentences	−0.53	**< .05**
Finite verbs in sentences	−0.61	**< .05**
Sentence construction	−0.36	> .10
Anagrams −pictures	−0.52	**< .05**
Anagrams +pictures	−0.66	**< .01**
wh-questions	−0.50	**< .05**

the 10% level. This might be due to the fact that the aphasia of some of the subjects was mild, but accompanied by a severe verbal apraxia. These subjects score relatively high on the Token Test, but very low on the Sentence Construction task. According to these results, we conclude that the tasks of the VAST are sufficiently valid.

INTERPRETING THE TEST DATA: TWO CASE STUDIES

In this section we report on two subjects as a way of illustrating how the VAST can be used to investigate the nature of a person's aphasic condition and to show how the results can be used to motivate therapy.

CASE 1: EL

EL was an 84-year-old retired butcher who had a cerebro-vascular accident (CVA) in his left hemisphere 6 months prior to testing. Initially he had, according to his speech and language therapist, a non-fluent aphasia, but at the time of testing he was quite fluent and had mild to moderate word finding difficulties, sometimes resulting in the production of phonemic paraphasias. There were no obvious physical problems. He used reading glasses and had some hearing loss, probably age related. The following is an example of his spontaneous speech. It is a response to the question ''Can you tell me what happened to you?''

Yes . . . that . . . tenth of July . . . tenth of January . . . second of January I had a full stroke and I couldn't speak and I couldn't speak at all I member sitting in the kitchen in the fire place and the . . . and he just said that ehm and I didn't know what to do and I was just standing there and all over sudden I fell down and I s I was thinking of things and I could thinking but I couldn't do anything and then my son in law came in and he came up and came up and set me and my wife found me then they saw the . . . the . . . anyhow the doctor came but . . . and then I was took into Reading.

A lexical analysis of 300 words revealed that the number of nouns (22) fell just within the range of non-aphasic control subjects[2] (range for controls 22–69) and that the number of different nouns used (20) was also normal (range for controls 18–64). Both the number of verbs (41) and the number of different verbs (21) fell within normal ranges (verb tokens: range for controls 28–51; verb types: range for controls 17–32).

The results on the VAST

Comprehension

Verb comprehension. EL scored 36/40 correct (range for controls 38–40). Three times he chose the semantically related verb and once the semantically related noun.

Sentence comprehension. Score: 25/40 correct (range for controls 35–40). The majority of the errors were due to pointing to the distractor with the reversed roles (12/15 errors), but the errors were almost equally divided between the actives, object and subject-cleft sentences. Remarkably, the passive sentences were selected most accurately: 8/10 correct. Two of the three items that triggered the choice of the lexical distractor were of the Agent-Verb-Theme type.

Grammaticality judgement. EL showed no problems with this task: 39/40 correct (range for controls 37–40).

Production

Action naming. Score: 28/40 correct (range for controls 37–40). Sometimes EL could not give a verb and described the object on the picture (e.g., *digging: spade*) or described the action with a more general word (e.g., *combing: doing her hair, jumping: going over a dip*) or he produced a semantic related action word (e.g., *sieving: baking* and *diving: swimming*). The factors name relatedness, transitivity, and frequency did not play a role in his performance.

Sentence construction. EL always produced grammatical sentences (20/20 correct, range for controls 16–20).

Anagram task with pictures. EL scored 18/20 correct (range for controls 20–20), reversing the thematic roles in two passives. No effect of reversibility can be noted.

Anagram task without pictures. EL did not make any errors on this task: 20/20 correct (range for controls 20–20).

[2] The data of the control speakers have been taken from the study of Edwards and Bastiaanse (1998).

Wh-anagram task. Score: 12/20 (range for controls 17–20). The majority of the errors were due to reversing the thematic roles (5/8 errors) and incorrect placing of the *wh*-word or a combination of the two (e.g., 1. Target: *where is the tourist filming the girl*? Response*: the tourist is filming where the girl?* and 2. Target: *what is the girl hugging in the stable?* Response: *is what hugging the girl in the stable?*).

Questions with the question word *where* contained the most errors (1/5 correct, versus *who* and *what* 4/5 correct and *when* 3/5 correct).

Conclusions

The results show that EL has mild problems comprehending actions as single words, but that he is more impaired in understanding reversible sentences. The pattern of errors indicates that he has a problem with understanding who is doing the action to whom, even in sentences where the thematic roles are in canonical order. The results on the grammaticality judgement task show that he is undisturbed in parsing the same types of irreversible sentences, indicating that EL's problems originate from a mapping deficit. The difficulty with understanding reversible sentences, even actives, is quite severe.The action naming task shows that he has trouble retrieving the correct semantic and/or phonological form of the verb, but this does not seem to play a role in his ability to construct sentences. This is also reflected in his spontaneous speech: the number of verbs used falls well within normal ranges. The sentence production tasks indicate that EL is able to form grammatical sentences, both in the constrained (anagram tests) and relatively unconstrained tasks (sentence construction task).

Suggestions for therapy

The results on the VAST indicate that EL's difficulties are in verb retrieval and that he also exhibits problems with thematic role assignment, possibly also the reason for his problems with *wh*-questions. Therefore, a therapy programme that concentrates on improving insight into thematic role structure is recommended, using a combination of mapping therapy, as described by, e.g., Jones (1986), Byng, Nickels, and Black (1994), Schwartz et al. (1994), and Haendiges, Berndt, and Mitchum (1996), and a block of therapy to facilitate the production of questions, for instance based on the design of Thompson et al. (1997) or Springer, Willmes, and Haag (1993). The results on the action naming task showed problems with verb retrieval, but these problems did not seem to interfere with his ability to construct sentences, nor with his spontaneous speech production. (We acknowledge the fact that the sample length may have been too short to examine the properties of the verbs used, e.g., specifity and light/heavy usage.) With these facts in mind, we would not prioritise treatment for verb finding.

CASE 2: DM

DM was referred for testing by his speech and language therapist who described him as a fluent aphasic who had made a good recovery since his CVA 12 months previous to the testing session. DM was aphasic following a large, left temporo-parietal intra-cerebral bleed that had been evacuated. There was a minimal hemiparesis on the right side of the body but the over-riding problem was the acquired aphasia. He was 74 years old at the time of testing, alert, knowledgeable, and interested in his condition. His spontaneous speech, while fluent, was slow with many incomplete sentences, many attempts to reformulate sentences, and frequent reference to his difficulties in retrieving specific

lexical items. He was concerned about his reduced verbal skills. He had previously been an undergraduate maths tutor who enjoyed cultural activities. He recognised that there had been a considerable improvement in his language abilities over the past 12 months which he attributed to the speech and language therapy he had received, his own hard work, and the help that his wife provided. His insights into his problems and his curiosity about the nature of the disorder probably also contributed to his good progress. He was keen to participate in the test and to discuss his performance on each section. Both DM and his therapist thought that the persisting deficit was anomic in nature and that the main difficulty lay in noun retrieval. Consequently, previous testing and therapy had been focused on nouns. The purpose of giving the VAST was to investigate areas of language production and comprehension that had not been explored.

Results on the VAST

Comprehension

Verb comprehension. DM scored 37/40 correct (range for controls 38–40). All errors involved pointing to the verb distractor picture.

Sentence comprehension. DM completed the sentence comprehension task, taking a great deal of time and care in selecting each target picture. On this task he scored 38/40 (range for controls 35–40) and his two errors involved one selection of the picture with the reversed roles (for an active sentence) and one selection of a lexical distractor (in a subject-cleft sentence).

Grammaticality judgement. As with the comprehension tasks, DM performed accurately but very slowly. He made two errors (38/40), one false negative and one false positive, both sentences were subject-clefts (range for controls 37–40).

Production

Action naming. DM's poorest performance was on the Action Naming task where he scored 16/40 correctly (range for controls 37–40). Here he clearly had great difficulty in retrieving the target verb. He frequently produced a semantically related verb or circumlocuted (for example *sewing → ironing . . . needle* and *thread . . . cooking . . . no, ploughing → picking up a flower* and *parachuting → coming down a parachute*.

Filling in finite verbs and infinitives in sentences. In the infinitive section, DM scored 6/10 (range for controls 8–10), failing to produce one of the verbs and making three semantic paraphasias. In the finite section, he achieved 8/10 (range for healthy speakers 8–10). Both errors in this section were lexical substitutions but were inflected for third person singular as the eliciting sentences demanded. There is no evidence from this brief exploration, then, that DM has problems with verb inflection and indeed no errors were noticed in his conversational speech. For him, therefore, retrieving the lexical verb rather than inflecting the verb was clearly a source of difficulty.

Sentence construction. DM had considerable difficulty with this task, scoring only 8/20 (range for controls 16–20). DM's difficulties with retrieving verbs as well as nouns became apparent. For example*: the child is crying → the woman is unhappy*, *the dog is biting the cat → the animal is biting the monkey* and *the girl is sleeping →*

the monkey is in bed—the girl is in bed with—the girl kisses the animal. This last example illustrates how his repeated attempts to reach a target could take him further away from the goal.

Anagrams without pictures and anagrams with pictures. DM scored 18/20 for the task without pictures (range for controls 20–20); 18/20 for the task with pictures (range for controls 20–20). He was extremely slow on each of these tasks, talking through each possibility, and checking and rechecking before he was satisfied with the word order. Both errors on the Anagrams without Pictures involved passive constructions, where he reversed the NPs; the two errors in the Anagrams with Pictures also involved passive sentences where he again reversed the NPs.

Wh-anagrams. DM scored all items correctly (20/20, range for controls 17–20). For most patients, these results could be dismissed as ''within normal limits'' but for DM, the obvious effort that was required for what for non-aphasic speakers is a simple and quick task, highlighted his persisting sentence processing problems. The time required could not be explained by lexical retrieval problems, as all lexical items were given in this test. His reactions and comments throughout revealed that he had difficulty in assigning NPs to their correct position within the target sentences. Additionally, notwithstanding his perfect score on the Wh-anagram task, he had difficulty in understanding that the position of the NP within the sentence could change the meaning of the sentence.

Conclusions

The results show that DM has retained his ability to understand both canonical and non-canonical sentences but this understanding comes at a price. He is very slow. A consequence of this is his diminished ability to participate in group conversations or in the type of conversations he enjoyed before the onset of his aphasia. The difficulties with verb retrieval were a surprise to him and his wife. Up to this date, DM and his wife had been aware of noun retrieval difficulties but were not aware of problems with verbs. Although no analyses of spontaneous speech were available, it is likely that DM relies heavily on a reduced number of verb types and on verbs with low specificity. His aphasia is comparatively mild (he made only 10 errors on the Token Test from the Aachen Aphasia Test: Miller et al., 2000) but the VAST was able to highlight areas of difficulties in a way that other assessments had not done. Although to many the language handicap might seem mild, to DM and his wife his language deficits remain a source of anxiety and interfere with activities they previously enjoyed and valued. The results of the VAST highlighted certain possibilities for future help.

Suggestions for therapy

The greater insights afforded by the VAST were welcomed by DM and his wife. By realising how sentence comprehension was difficult for him, even when the individual lexical items in each sentence were known to him, both DM and his wife gained greater insight into the nature of his aphasia. First, neither DM nor his wife had realised the extent of difficulty that DM had with parsing and understanding sentences. Although he scored well on the Sentence Comprehension task, the time he took and his commentary on the task gave some insights into why he found participating in conversations difficult. It was clear that the difficulties he encountered were not only lexical. Second, the VAST

also demonstrated difficulties in retrieving verbs. For this subject, therefore, it might be helpful, to target therapy on verb retrieval as outlined in Mitchum and Berndt (1994) in order to improve his output. Given that there is no evidence that finite verbs are any harder for him to retrieve than infinitives, and that the performance on sentence construction was comparable to that of producing verbs as single words, it would be useful to practise verb retrieval both at the word and at the sentence level.

CONCLUSION

We developed a test for the assessment of comprehension and production of verbs and sentences, which is reliable, valid, and able to discriminate between normal and aphasic behaviour. Our experience to date has demonstrated that the tasks from the test battery can not only illuminate aspects of aphasia, but also provide explanations for the deficits revealed and provide suggestions for therapy. There is no easy and simple connection between assessment and therapy but in making explicit suggestions we have tried to take some first steps along this route. We are mindful that the work we quote is only a selection from the literature that is now appearing on therapy and that new methods of treatment are constantly being developed. The studies we mention are all empirical and all deficit-based, as the function of the VAST is to examine what we contend is central in aphasia, a language deficit. Of course, we acknowledge that therapists working with people with aphasia need to consider not only the linguistic deficits but also how these deficits impact upon the person. We envisage, therefore, that this test battery will become one of the many tools to be used in the assessment of people with aphasia.

Manuscript received 20 September 2001
Manuscript accepted 21 March 2002

REFERENCES

Balogh, J.E., & Grodzinsky, Y. (2000). Levels of linguistic representation in Broca's aphasia: Implicitness and referentially of arguments. In R. Bastiaanse, & Y. Grodzinsky (Eds.), *Grammatical disorders in aphasia: A neurolinguistic perspective*. London: Whurr.

Basso, A., Razzano C., Faglioni, P., & Zanobio, M.E. (1990). Confrontation naming, picture description and action naming in aphasic patients. *Aphasiology*, *4*, 185–195.

Bastiaanse, R., & Edwards, S. (2001). Word order and finiteness in Dutch and English Broca's and Wernicke's aphasia. *Brain and Language*, *79*, 72–74.

Bastiaanse, R., Edwards, S., & Kiss, K. (1996). Fluent aphasia in three languages: Aspects of spontaneous speech. *Aphasiology*, *10*, 561–575.

Bastiaanse, R., & Jonkers, R. (1998). Verb retrieval in action naming and spontaneous speech in agrammatic and anomic aphasia. *Aphasiology*, *12*, 951–969.

Bastiaanse, R., Maas, E., & Rispens, J. (2000). *Werkwoorden- en Zinnentest (WEZT)*. Lisse: Swets & Zeitlinger.

Bastiaanse, R., & van Zonneveld, R. (1998). On the relation between verb inflection and verb position in Dutch agrammatic aphasics. *Brain and Language*, *64*, 165–181.

Berndt, R.S., Haendiges, A.N., Mitchum, C.C., & Sandson, J. (1997a). Verb retrieval in aphasia: 1. Characterizing single word impairments. *Brain and Language*, *56*, 68–106.

Berndt, R.S., Mitchum, C.C., Haendiges, A.N., & Sandson, J. (1997b). Verb retrieval in aphasia: 2. Relationship to sentence processing. *Brain and Language*, *56*, 107–137.

Bird, S., & Franklin, S. (1996). Cinderella revisited: A comparison of fluent and nonfluent aphasic speech. *Journal of Neurolinguistics*, *9*, 187–206.

Breedin, S., Saffran, E., & Schwartz, M. (1998). Semantic factors in verb retrieval: An effect of complexity. *Brain and Language*, *63*, 1–31.

Butterworth, B., & Howard, D. (1987). Paragrammatisms. *Cognition*, *26*, 1–37.

Butterworth, B., Pazeri, M., Semenza, C., & Ferreri, T. (1990). Paragrammatisms: A longitudinal study of an Italian patient. *Language and Cognitive Processes*, *5*, 115–140.

Byng, S. (1988). Sentence processing deficits: Theory and therapy. *Cognitive Neuropsychology*, *5*, 629–676.

Byng, S., Nickels, L., & Black, M. (1994). Replicating therapy for mapping deficits in agrammatism: Remapping the deficit? *Aphasiology*, *8*, 315–341.

Caramazza, A., & Zurif, E.B. (1976). Dissociation of algorithmic and heuristic processes in language comprehension: Evidence from aphasia. *Brain and Language*, *3*, 575–582.

Druks, J., & Masterson, J. (2000). *An Object and Action Naming Battery.* Hove, UK: Psychology Press.

Edwards, S. (2000). Grammar and fluent aphasia. *Brain and Language*, *74*, 560–563.

Edwards, S., & Bastiaanse, R. (1998). Diversity in the lexical and syntactic abilities of fluent aphasic speakers. *Aphasiology*, *12*, 99–117.

Francis, W.N., & Kucera, H. (1982). *Frequency analysis of English usage: Lexicon and grammar.* Boston: Houghton Mifflin.

Friedmann, N., & Grodzinsky, Y. (1997). Tense and agreement in agrammatic production: Pruning the syntactic tree. *Brain and Language*, *56*, 397–425.

Goodglass, H., & Kaplan, E. (1983). *Boston Diagnostic Aphasia Examination.* Philadelphia: Lea & Febiger.

Grodzinsky, Y. (1995). A restrictive theory of agrammatic comprehension. *Brain and Language*, *50*, 27–51.

Grodzinsky, Y. (2000). The neurology of syntax: Language use without Broca's area. *Behavioral and Brain Sciences*, *23*, 1–21.

Grodzinsky, Y., & Finkel, L. (1998). The neurology of empty categories: Aphasics' failure to detect ungrammaticality. *Journal of Cognitive Neuroscience*, *10*, 281–292.

Haendiges, A.N., Berndt, R.S., & Mitchum, C.C. (1996). Assessing the elements contributing to a ''mapping'' deficit: A targeted treatment study. *Brain and Language*, *52*, 276–302.

Hagiwara, H. (1995). The breakdown of functional categories and the economy of derivation. *Brain and Language*, *50*, 92–116.

Huber, W., Poeck, K., & Willmes, K. (1984). The Aachen Aphasia Test. In F.C. Rose (Ed.), *Advances in neurology; Vol. 42: Progress in aphasiology*. New York: Raven Press.

Jones, E.V. (1986). Building the foundation for sentence production in a nonfluent aphasic. *British Journal of Disorders of Communication*, *21*, 63–82.

Jonkers, R. (2000). Verb finding problems in Broca's aphasia: The influence of transitivity. In R. Bastiaanse & Y. Grodzinsky (Eds.), *Grammatical disorders in aphasia: A neurolinguistic perspective*. London: Whurr.

Jonkers, R., & Bastiaanse, R. (1996). The influence of instrumentality and transitivity on action naming in Broca's and anomic aphasia. *Brain and Language*, *55*, 37–39.

Kay, J., Lesser, R., & Coltheart, M. (1992). *Psycholinguistic Assessment of Language Processing in Aphasia*. Hove, UK: Lawrence Erlbaum Associates Ltd.

Kohn, S.E., Lorch, M.P., & Pearson, D.M. (1989). Verb finding in aphasia. *Cortex*, *25*, 57–69.

Linebarger, M., Schwartz, M., & Saffran, E. (1983). Sensitivity to grammatical structure in so-called agrammatic aphasics. *Cognition*, *3*, 361–392.

Luketela, K. Shankweiler, D., & Crain, S. (1995). Syntactic processing in agrammatic aphasia by speakers of a Slavic language. *Brain and Language*, *49*, 50–76.

Marshall, J. (1995). The mapping hypothesis and aphasia therapy. *Aphasiology*, *9*, 517–539.

Marshall, J., Black, M., & Byng, S. (1998). *The Sentence Processing Resource Pack*. London: Winslow Press.

Miceli, G., Silveri, M.C., Villa, G., & Caramazza, A. (1984). On the basis of agrammatics' difficulty in producing main verbs. *Cortex*, *20*, 207–220.

Miller, N., De Bleser, R., & Willmes, K. (2000). The psychometric properties of the English language version of the Aachen Aphasia Test (EAAT). *Aphasiology*, *14*, 683–722.

Mitchum, C.C., & Berndt, R.S. (1994). Verb retrieval and sentence construction: Effects of targeted intervention. In M.J. Riddoch & G.W. Humphreys (Eds.), *Cognitive neuropsychology and cognitive rehabilitation*. Hove, UK: Lawrence Erlbaum Associates Ltd.

Niemi, J. (1990). Nonlexical grammatical deviations in paragrammatism. *Folia Linguistica*, *24*, 389–404.

Orgass, B. (1976). Eine Revision des Token Tests. Teil I und II. *Diagnostica*, 22, 141–156.

Schwartz, M.F., Fink, R.B., & Saffran, E.M. (1995). The modular treatment of agrammatism. *Neuropsychological Rehabilitation*, *5*, 97–127.

Schwartz, M.F., Linebarger, M., Saffran, E.M., & Pate, D. (1987). Syntactic transparency and sentence interpretation in aphasia. *Language and Cognitive Processes*, *2*, 85–113.

Schwartz, M.F., Saffran, E.M., Fink, R.B., Myers, J.L., & Martin, N. (1994). Mapping therapy: A treatment program for agrammatism. *Aphasiology*, *8*, 19–54.

Springer, L., Willmes, K., & Haag, E. (1993). Training in the use of *wh*-questions and prepositions in dialogues: A comparison of two different approaches in aphasia therapy. *Aphasiology*, *7*, 251–270.

Thompson, C.K., Shapiro, L.P., Ballard, K.J., Jacobs. M.J., Schneider, S.L., & Tait, M.E. (1997). Training and generalized production of *wh*- and NP-movement structures in agrammatic aphasia. *Journal of Speech and Hearing Research*, *40*, 193–206.

Thompson, C.K. Shapiro, L.P., Tait, M.E., Jacobs, B.J., & Schneider, S.L. (1996). Training *wh*-question production in agrammatic aphasia: Analysis of argument and adjunct movement. *Brain and Language*, *52*, 175–228.

Whitworth, A. (1995). *Thematic roles in production (TRIP): An assessment of word retrieval at the sentence level*. London: Whurr.

Williams, S.E., & Canter, G.J. (1987). Action-naming performance in four syndromes of aphasia. *Brain and Language*, *32*, 124–132.

Zingeser, L.B., & Berndt, R.S. (1988). Grammatical class and context effects in a case of pure anomia: Implications for models of language production. *Cognitive Neuropsychology*, *5*, 473–516.